LXVI. *A Letter from Monſieur* de L'Iſle, *of the* Royal Academy of Sciences *at* Paris, *to the Reverend* James Bradley, *D. D. Aſtronomer Royal, and* Savilian *Profeſſor of Aſtronomy at* Oxford.

Tranſlated from the French.

SIR, Paris, Nov. 30, 1752.

Read Feb. 21, 1754.

I Have received the letter, which you did me the honour of writing to me on the 22d of Auguſt this year, O. S. together with the obſervations made by you at Greenwich, which correſpond with thoſe of Monſieur de la Caille made at the cape of Good Hope, with relation to the parallax of the Moon, Venus, and Mars. I now ſend you, according to your deſire, the compariſon, which I have made between your obſervations and thoſe of Monſieur de la Caille. I have, at preſent, only compared thoſe of Mars; and tho' a conſiderable number of them have been made by you both, yet I find but ſix, which really correſpond, that is, which have been made on the ſame ſtar, and in the ſame night; there being between them only the interval of time neceſſary for paſſing from the meridian of the cape to that of Greenwich. From many obſervations of Monſieur de la Caille, compared with thoſe made in Europe, we are aſſured, that the cape of Good Hope is eaſt of Greenwich $1^h\ 14'$; and this is the difference of longitude, which I have ſuppoſed, in order to reduce your obſervations to thoſe of the cape.

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As you have not ſet down your firſt obſervations on the ſuperior or northern limb of Mars, as Monſieur De la Caille mention'd, that he would do on his part; I have been obliged to ſuppoſe the apparent diameter of Mars known; and, in the uſe of your firſt obſervations, I have conſidered it, as, or a little leſs than, you found it, when you began to obſerve.

The firſt obſervation, which you made correſponding with that of Monſieur De la Caille, is of Auguſt 31. in the morning, on which day you found, that the center of Mars in the meridian was 11′ 21″ ſouth of ſtar 33 of Piſces. If we deduct 13″ for the apparent ſemidiameter of Mars at that time, 11′ 8″ will be the difference of the declination of the northern limb of Mars and the ſtar in the meridian of Greenwich. The diurnal variation of Mars in the declination was, at that time, 4′ 47″; whence we may conclude it to be 14″ 48‴ for 1ʰ 14′, to be ſubtracted from the diſtance obſerved at Greenwich, in order to reduce it to what it would have been in the meridian of the Cape: So that, by your obſervation, the northern limb of Mars would have been ſouth of the ſtar 10′ 53″ 12‴. Monſieur De la Caille found, that ſtar north of the northern limb of Mars 10′ 18″ 24‴. The difference therefore is 34″ 48‴, for the ſum of the parallaxes of the height of Mars, on that day, in the meridian of Greenwich and the Cape.

Here follows what I have found, with reſpect to the other days.

	′	″	‴
Sept. 4. in the morning, at Greenwich, Rigel ſouth of the centre of Mars . .	7	50	30
Semidiameter of Mars	0	13	00

	′	″	‴
Rigel ſouth of the northern limb of Mars at Greenwich	8	3	30
Diurnal variation in the declination 4′ 8″, anſwering to 1h 14′	0	12	47
Rigel ſouth of the northern limb of Mars by the obſervations of Greenwich reduced to that of the Cape . .	8	16	17
The ſame diſtance obſerved at the Cape	8	51	30
Difference or ſum of the parallaxes of the height of Mars . . .	0	35	13
Oct. 3. in the evening, at Greenwich, the northern limb of Mars was ſouth of the ſtar λ of Aquarius	4	42	30
The diurnal variation of Mars in declination 0′ 59″, anſwering to 1h 14′	0	3	2
On the 6th of September Mars ſouth of the ſtar, reduced to the meridian of the Cape	4	45	32
The diſtance obſerved at the Cape . .	4	9	54
The ſum of the parallaxes of the height of Mars	0	35	38
Oct. 4. in the evening, at Greenwich, the ſtar λ was north of the northern limb of Mars	3	26	0
The diurnal variation in declination 1′ 18′, anſwering to 1h 14′ . .	0	4	1

	′	″	‴
The ſtar northern Sept. 6. of Mars, reduced to the meridian of the cape	3	30	1
Obſerved at the Cape	2	58	12
The ſum of the parallaxes of the height of Mars	0	31	49
Oct. 7. in the evening, at Greenwich, the ſtar λ ſouth of the northern limb of Mars	2	17	0
The diurnal variation of the declination 2′ 10″, anſwering to 1h 14′ . .	0	6	42
The ſtar ſouth on the 6th of Sept. of Mars, reduced to the Cape . .	2	10	18
Obſerved at the Cape	2	36	36
Sum of the parallaxes of the height of Mars	0	26	18
Oct. 9. in the evening, at Greenwich, the ſtar λ ſouth of the northern limb of Mars	7	35	0
Diurnal variation of the declination 2′ 49″, anſwering to 1h 14′ . .	0	8	42
The ſtar λ ſouth of the northern limb of Mars, reduced to the Cape . .	7	26	18
Obſerved at the Cape	7	57	24
The ſum of the parallaxes of the height of Mars	0	31	6

This ſum of the parallaxes, which I have found from each obſervation, is the angle at Mars formed by the two viſual rays taken by two obſervers of the ſame point of Mars. I afterwards deduced, from every one of theſe ſix obſervations, the horizontal parallax of Mars, by taking it in the ſame ratio to the total ſine, which that angle at Mars is to the ſum of the ſines of the apparent diſtance of Mars in the zenith of each obſerver; and I found the horizontal parallax of Mars as you ſee hereunder.

		″ ‴		″ ‴	
1751. Aug.	31.	26 42	the horizontal parallaxes of ♂ for each obſervation.	0 27	additional corrections for reducing the parallaxes to what they ought to be in the oppoſition of Mars to the Sun.
Sept.	14.	27 10		0 1	
Oct.	3.	27 35		2 34	
	4.	24 34		2 46	
	7.	20 20		3 20	
	9.	27 35		3 46	

As the horizontal parallax of Mars varies according to the diſtance of Mars from the Earth, I have calculated, by Dr. Halley's tables, the real diſtances of Mars from the Earth at the times of your ſix obſervations above-mentioned, and at the time of the oppoſition of Mars to the Sun; after which, making uſe of the ratio between theſe diſtances, I examined how much the horizontal parallax of Mars muſt be leſs, in each of your obſervations, than at the time of that oppoſition. Theſe are the quantities, which compriſe the ſmall table given above, under the title of corrections. Theſe quantities, being added to the parallax deduced ſimply from each obſervation, have given the horizontal parallax, ſuch as it ought to be in each obſervation reduced to the time of the oppoſition.

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The calculations being made, here follows what I have found with reſpect to the horizontal parallax of Mars at the time of the oppoſition.

By the obſervation of	31 Aug.	27″	9‴	
	14 Sept.	27	11	
	3 Oct.	30	9	*
	4	27	20	
	7	23	40	*
	9	27	39	

By taking a mean or arithmetical medium between theſe 6 determinations, we may conclude the horizontal parallax of Mars, at the time of the oppoſition, to be 27″ 11‴: but as there are two determinations, which differ from each other about 3″, and which are thoſe of the 3d and 7th of October; we may reject them, and then we ſhall find the mean between the other four to be 27″ 20‴. Hence you ſee, Sir, that whether we reject thoſe two determinations, or employ them, the horizontal parallax of Mars, at the time of the oppoſition, comes out near 27″ $\frac{1}{4}$; and according to the ratio of the diſtance of the Sun and Mars from the Earth at that time, we conclude the horizontal parallax of the Sun to be about 10″ $\frac{1}{3}$.

This is what I have been able hitherto to conclude from your obſervations of Mars, with reſpect to the parallax of the Sun. Having made the ſame calculations from my own obſervations, and thoſe of other aſtronomers, which I could hitherto collect; I have found very near the ſame parallax of the Sun, by taking

taking a medium between all the obſervations of each aſtronomer. But I have not always found, that the different obſervations of other aſtronomers agree ſo well with each other, as yours do: For which reaſon, I have been a little more doubtful in concluding the true parallax of the Sun; and I have no hopes of being able to determine it more preciſely, than I have done from your obſervations, till I have verified the obſervations of all the other aſtronomers by each other, and rejected thoſe, which ſhall be found evidently faulty, after a rigorous examination of them, which I intend to make.

I have not yet compared your other obſervations with thoſe of Monſieur de la Caille: I propoſe to do it, as ſoon as I ſhall have leiſure. I ſend you, in the mean time, his obſervations, which our Academy has publiſhed, in order to give other aſtronomers the ſatisfaction of comparing them with their own.

I do not doubt, that you, Sir, have thought of the tranſit of Mercury over the Sun, expected on the 6th of May next year. I have made a calculation of it from Dr. Halley's tables, rectified, not only by corrections given by himſelf after the tranſit in 1723, but likewiſe from the obſervations made upon the tranſit in 1740, at Cambridge in New England; ſo that I hope to be exact within a few minutes, with reſpect to the ingreſs and emerſion of Mercury into and from the diſk of the Sun.

I have calculated, that the ingreſs will be at $2^h\ 44'$ in the morning at Paris, and the emerſion at $10^h\ 37'$, and, conſequently, the duration of the paſſage $7^h\ 53'$; and, likewiſe, that Mercury will paſs near the centre of the Sun; which is ſufficient to inform the aſtronomers,

nomers, of the preſent age, of the time, when they are to expect the tranſit: Whereas thoſe, who ſhall make uſe of Caſſini's tables, from which our ephemerides, and thoſe of Italy, are calculated, will be miſtaken no leſs than 4 hours; the tranſit being to happen ſo long ſooner by thoſe tables, than by Dr. Halley's. This difference appeared to me conſiderable enough to deſerve, that aſtronomers ſhould be acquainted with it; and this I am preparing to do by an advertiſement, which will be immediately publiſhed.

In the mean time, I thought it proper to ſend to the Eaſt Indies, to endeavour to procure from thence exact obſervations of the tranſit in thoſe places, where the whole duration may be obſerved. The emerſion may be ſeen, in part of North America, a little after ſun-riſe; and ſince an accurate obſervation, which may be made there, will ſerve to determine the parallax of the Sun, if thoſe obſervations are compared with the others to be made in the Eaſt Indies, I am obliged to write to you, to requeſt you to recommend to all thoſe, who ſhall be able, and have an opportunity to make this obſervation, in your Engliſh colonies, to attend to it; and that the Royal Society will likewiſe make uſe of their intereſt for that purpoſe.

I have found, that at Cambridge near Boſton, where Mr. Winthrop obſerved the tranſit in 1740, Mercury's emerſion from the Sun will be at $5^h\ 45'$ in the morning; which is 51 minutes after ſun-riſe: At New York it will be $5^h\ 32'$, which is 34 minutes after ſun-riſe; in other places, in the neighbourhood, it will be, in proportion, nearer or farther from ſun-riſe; as will be eaſily calculated. But it were to be

wiſh'd,

wiſh'd, that the obſervation ſhould be made principally in thoſe places, the longitude of which is known, with the utmoſt exactneſs poſſible, from other obſervations; which would ſerve the better to determine the parallax of the Sun by the compariſon of thoſe obſervations with ſuch, as ſhall be made in the Eaſt Indies. We already have a conſiderable number of obſervations relating to the longitude of Cambridge and New York, beſides the new ones, which may be ſtill made there; ſo that thoſe two places would be the moſt proper to obſerve the approaching tranſit of Mercury over the Sun; which I deſire you to recommend to the Royal Society, in order that they may exert all their intereſt to procure ſuch obſervations. I am, with perfect eſteem,

SIR,

Your moſt humble, and

moſt obedient ſervant,

De L'Iſle.

Deſcription of a Piece of Mechaniſm contrived by James Ferguſon, *for exhibiting the Time, Duration, and Quantity, of Solar Eclipſes, in all Places of the Earth.*

Read Feb. 21, 1754. THE principal Parts of this machine (See *Plate* XIX.) are,

1. A terreſtrial globe turned round, by a handle, on